NEWS RELEASE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
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Address
by
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AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS
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The opportunity to meet with the New York Section of the American Institute of Aeronautics and Astronautics is a welcome one. It is a particular pleasure to be with you during the month which marks the fifth anniversary of the National Aeronautics and Space Administration--the nation's first organized effort to master and use the space environment.

It might be appropriate, in view of this anniversary, to review some of the progress which has been made in this great and challenging national effort, and our plans and hopes for the future.

Tolstoi said, "From the child of five to myself is but a step, but from the new-born baby to the child of five is an appalling distance." From our first feeble efforts to venture into space to, in the Wall Street Journal's words, the "professionalism" of today, was also an appalling distance.

You are all aware of the limitations, during our early ventures in space, imposed by the inadequacy of our launch vehicles. Development of more powerful boosters was an obvious and immediate requirement, once the nation had concluded to undertake a major effort in space. During the intervening years great progress has been made in developing the basic ingredients of space power. The first stage of the Saturn I rocket has already had four successful flight tests.

NASA has also contracted with American industry, which carries out more than 90 per cent of NASA's work, for all the major components of the Saturn V launch vehicle, which will launch the first astronauts toward their exploration of the moon. The required spacecraft, first in the Gemini program, which will enable our astronauts to orbit the earth for up to two weeks, and then in the Apollo program, capable of as much as two months in earth orbit, are also under contract.

It is important to note, in connection with these spacecraft, that they will not only get mankind to the moon. In preparation for the lunar journey, U.S. astronauts will spend about 2,000 hours in near-earth orbit, learning the techniques of rendezvous, docking and operational space capability.

While developing the equipment required to permit the United States to achieve space leadership, we have also undertaken the construction of the massive ground engineering facilities, to build, test, and launch the rockets of the future. These include facilities such as the Manned Spacecraft Center at Houston, Texas; the Michoud Assembly Plant in New Orleans; the Test Facility nearby in Mississippi; and the new launch facilities at

Merritt Island, adjacent to Cape Canaveral.

This arrangement of basic facilities has been planned to take advantage of the water transportation which is required to transport the tremendous launch vehicles of the future.

Let us turn now to the specific achievements of the nation's first five years in space. Since 1958, the United States has launched more than 100 satellites of the earth and six U.S. spacecraft have escaped the gravity of the earth to enter orbits about the sun. One of the six struck the moon and another passed within 21,650 miles of the planet Venus.

The United States has learned to guide and control the flight of unmanned spacecraft by radio signals, and to return them to the earth. The first man-made object returned to earth from space was a United States spacecraft, Discoverer XIII, on August 11, 1960.

In 1962, the United States perfected the remote technique of firing a rocket on board a spacecraft traveling away from the earth, to correct its course on a flight to another body in the solar system. Following experiments with the Ranger spacecraft, traveling toward the moon, success was achieved on the Venus mission of Mariner II, launched August 27, 1962. The initial launch placed the spacecraft on a trajectory which would miss the planet by a distance of 233,000 miles, too great to obtain the desired measurements of conditions on Venus.

On September 4, 1962, when Mariner II was about 1½ million miles from earth, its course was changed to bring it within 21,650 miles of the planet, well within the target area required to obtain data. The guidance and control demonstrated on this flight was equivalent to hitting a standard-sized automobile from a distance of 280 miles.

In 1963, the United States successfully launched a satellite, Syncom II, into a circular orbit 22,300 miles above the earth. At this altitude, satellites revolve about the earth every 24 hours--at the same rate as the earth's daily rotation--and thus remain in a fixed position above a given spot on earth. To achieve this orbit, with the three-stage Delta rocket, it was necessary to launch the satellite into an elliptical orbit that reached a maximum altitude of 22,300 miles and then to fire a fourth rocket motor to speed it up and keep it in place. The guidance required was the most difficult and spectacular yet achieved by any nation.

Considerable progress has been made in the development of electrical power sources for spacecraft. Vanguard I, launched March 17, 1958, was the first satellite to make use of the energy of the sun to generate electrical power. After more than five and a half years, the solar cell on Vanguard I is still providing power for the transmission of radio signals that make it possible to measure changes in the satellite's orbit. With these long-term observations, very precise calculations are being made of the shape and the distribution of mass of the earth. Many United States spacecraft have employed solar power sources in the years since 1958.

The United States has pioneered in the use of nuclear energy for space power. The first such device was a 4½-pound generator fueled with radioactive plutonium, which provided electricity for the Transit 4A satellite, launched in June, 1961.

Considerable progress has been made in the development of engines that will employ nuclear energy for propulsion in space. Several full-scale ground tests have been carried out in Project Rover, a program to develop a rocket engine in which a nuclear reactor will heat hydrogen gas sufficiently so that it will be expanded through a rocket nozzle and provide high thrust. Research is well advanced with respect to several kinds of devices that will make use of electrical energy generated by nuclear reactors to accelerate gases and provide low thrust over long periods of time.

Also in the area of propulsion, the United States has developed rocket engines that can be stopped and started again in space. The first restart in space was accomplished by the Thor Able-Star engine on April 13, 1960. More recently, restarts have been accomplished on a regular basis with the larger Agena vehicle.

To communicate with, control, track, and obtain data from manned and unmanned spacecraft, the United States has established several systems of radio and radar stations around the world.

One such system is the earth satellite network, which handles unmanned earth satellites. A second system is the deep space network, which provides for such needs in connection with spacecraft launched to the moon, the planets, and interplanetary space. A third is the manned space flight network, which was developed for Project Mercury.

In the Mariner II mission, the deep space network commanded the spacecraft instruments to turn on and off during the Venus passage on December 14, 1962, when it was 36 million miles distant from the earth. Signals were received for three weeks after the spacecraft passed Venus, until it reached a distance of 53.9 million miles from the earth.

The lack of launch vehicle power has hampered the United States most in the area of manned space flight. According to Soviet announcements, each Vostok spacecraft employed to launch a man into orbit has weighed in excess of 10,000 pounds. With the Atlas launch vehicle, the United States has been limited to payloads of about 3,000 pounds in earth orbit.

Because of this limitation in launch vehicle power, it has been necessary to make stringent efforts to hold to a minimum the weight of all components and systems of the Mercury spacecraft. The weight savings registered in Project Mercury will be of great value in future manned space flight programs. When greater lifting capacity becomes available, the ability to hold weight to low levels will add greatly to United States accomplishments.

Project Mercury was initiated on October 7, 1958, within a week after the National Aeronautics and Space Administration came into existence. In the five years that followed, the United States carried out six manned space flight missions, two on suborbital trajectories and four into orbit about the earth. Each mission was carried out successfully and on each flight the astronaut returned to earth without harm.

In Project Mercury, the United States learned:

-- To design, build, and test a spacecraft that will carry a man more than 100 miles from the earth's surface, protect him against the high acceleration of launching, provide atmosphere for him to breathe during flight through the vacuum of space, maintain its orientation automatically or under the astronaut's control, generate the thrust to return from orbit, withstand the searing heat of re-entry and descend safely to the earth.

-- To adapt a launch vehicle, intended for missile propulsion, so that it is sufficiently safe and reliable for manned flight, and to incorporate in this vehicle the means of detecting impending malfunction in time to enable the spacecraft to be safely separated from the launch vehicle in an emergency.

-- To conduct manned space flight operations on an immediate-action basis, with the aid of a world-wide network of radio and radar stations, based upon information received from thousands of miles away, sometimes on the other side of the earth.

-- To establish accurately the spacecraft's location after it has come down in the ocean, and to recover it in a short period of time.

-- To select and train astronauts so that they can perform in space as well as a test pilot can perform in the earth's atmosphere, and to provide controls and displays in the spacecraft that will enable the pilot to back up his automatic systems manually.

-- That man can withstand the high accelerations of a rocket launching, up to 34 hours of zero gravity, and a period of high acceleration on re-entry, without any ill effect upon his ability to carry out his assigned tasks.

Perhaps most important, the United States has learned that man can contribute materially to space exploration. As a test pilot and engineer, he can enhance the reliability and effectiveness of the space flight system. As an observer, he can increase the amount and value of the scientific information obtained.

Much has already been learned in space science and practical applications.

A most important discovery was made by the first United States satellite, Explorer I, launched in 1958. Professor James A. Van Allen of the State University of Iowa reported the existence of a zone of radiation consisting of electrically charged particles trapped by the earth's magnetic field, at altitudes above 500 miles. Numerous satellites and space probes launched since that time have made it possible to measure the extent of this zone, determine its nature, and establish how it is affected by the activity of the sun.

The relationships between the sun and the earth that have been uncovered with the aid of satellites have opened up a whole new area of science. It has been established that solar activity affects conditions on earth in a number of ways.

The sun's energy output, although almost constant with respect to visible light and radiation in the wavelengths near that of the visible range, fluctuates violently with respect to X-rays, ultraviolet light, and charged particles. Occasionally, great clouds of charged particles are flung into interplanetary space by eruptions called flares. If a flare is pointed properly, the cloud reaches the earth and interacts with its magnetic field, the upper atmosphere, and the trapped radiation belt, and the rate of arrival of cosmic rays is affected.

Presumably, there is a relationship between the sun's activity and the weather on earth, although its nature has not yet been established.

With respect to earth, analysis of information gathered by satellites has made it possible to determine that its shape is somewhat different from what we previously believed. Instead of a slightly oblate--or flattened--sphere, as previously believed, the earth has been found to be slightly pear shaped.

There are three important areas in which space technology has been employed to develop useful applications--in communications, in weather observation, and in navigation.

In communications, the United States has successfully launched three types of experimental satellites--passive, low-altitude active, and high-altitude active.

The Echo I balloon satellite, launched in 1960, is an example of a passive communications satellite. The surface of the 100-foot balloon served as a reflector for radio signals, making it possible to transmit them between greater distances on earth than would have been possible otherwise.

An active communications satellite carries a radio receiver and a transmitter. Building upon technology developed with the Score satellite in 1958 and the Courier satellite in 1960, the United States successfully launched the first Telstar and Relay satellites in 1962 and a second Telstar in 1963. These three low-altitude active communications satellites successfully conducted the first demonstrations of transoceanic television transmissions.

The first successful high-altitude active communications satellite, Syncom II, was launched on July 26 of this year in a synchronous 24-hour orbit which, in effect, causes it to hover in a fixed location above the earth. This type of satellite can make possible a communications system that would join most points on earth with as few as three satellites.

Many more satellites would be required for any system operated at lower altitudes.

In meteorology, seven successful Tiros satellites have been launched and have returned to earth hundreds of thousands of photographs of cloud cover. Many of these have been used in the preparation of operational weather forecasts. The Tiros satellites have also pioneered the use of infrared measurements to determine the temperature and rate flow of heat to and from areas of the earth under observation.

I have given you but a sketchy review of the space activity of NASA during its first five years. But it illustrates why the Wall Street Journal, reporting on Major Gordon Cooper's flight, said:

"Yesterday (The space age) stepped over an invisible line...the invisible line between the adventurer pushing into the unknown and true professionals setting forth into chartered seas. This was the impression which by the end of the day had overridden all others. The awe at the moment of blast-off, the marvel at listening to a man in space above Australia, these things contain their wonders. But the greatest wonder... is that these things should pass from fantastic adventure to the commonplace routine of man."

With the completion of Project Mercury and the accompanying vigorous forward movements toward the successful completion of Projects Gemini and Apollo, patterns of management have emerged which offer to the United States power which is almost as vital and important as the demonstrations of space power in flight.

We realize that as a nation we are going through a new and vital experience in achieving the mastery of space. In terms of technical requirements, the U.S. Manned Space program involves about 20 times the complexity of the Minuteman program. But this job is underway, and rapid progress is being made. We have undertaken to perform the largest job of research, of development and of manufacture ever attempted by this or any nation. There is required here the mobilization of the best efforts in these areas.

The national ability proven in the successful mobilization of these efforts is a clear indication of national strength and this strength is currently being both emphasized and demonstrated in our national space program. The task of bringing together a strong university-industry-government team, of doing 90 per cent of business in industry, of managing large contracts, of doing research with 4,000 experimenters on college campuses, and in cooperating with scores of government agencies, is complex and difficult. It means that to do the best and most efficient job, to deliver this extra strength, an agency must constantly examine its management structure to see if it is doing the best job.

After Project Mercury, the National Aeronautics and Space Administration began a careful reassessment of its management capabilities. Steps have been taken to get on with the job at the very highest level of efficiency. We have attracted more men to the agency who are thoroughly experienced in our nation's previous ballistic missile and space programs and who have the confidence of their colleagues within the government and without.

Dr. George Mueller, a vice president of Space Technology Laboratories, one of the pioneers in the development of the ballistic missile program, has joined NASA to head the manned space flight program. Dr. E. B. Doll, also of Space Technology Laboratories, has joined the agency in a six-month management improvement effort in manned space flight. Robert Young, one of the industry's finest propulsion authorities and a vice president of Aerojet General, is now working at Huntsville with Dr. von Braun on the big boosters. They join a respected team of proven performance. Reorganizational plans have been set in motion at Huntsville, Cape Canaveral, and Houston, as well as in the headquarters manned space flight office.

The agency has clearly demonstrated its ability to attract this kind of top flight talent from industry and its flexibility in being able to make the necessary management changes to strengthen a program at the very time it is making its greatest strides forward.

Let us examine briefly what is included within the $20 billion cost that has been estimated for this program.

One of the major costs is related to the development of large launch vehicles and their rocket motors. It is estimated that $7 billion will be expended in this area. This development effort is well under way. The new engines utilizing the hydrogen technology and the giant 1.5 million pound thrust F-1 engine already have been operated during the course of their development.

The development in this area, however, has a far greater importance than supporting a manned lunar landing. The development of launch vehicle lifting capabilities equivalent to those of the Saturn family of vehicles is essential to the ability of this country to successfully support future operations in space. We have already learned the lesson that the magnitude of a nation's capability in space is measured by the payload capability of its launch vehicles. This nation must never again find itself in the position of lacking the capability to launch large payloads into space.

A second major area of cost related to the manned lunar landing program is that involved in development of the manned spacecraft. This cost, which amounts to $6 billion includes the two-man Gemini and the three-man Apollo spacecraft with the module that provides its service functions as well as the two-man excursion module that will be used to land men on the surface of the moon.

Like the launch vehicle and propulsion systems the work on these components is well underway. The Gemini and Apollo command and service module system will not only prove out an extensive capability for space flight and train the crews, but will also have many uses in the future for near-earth manned space operations. Consequently, they represent the next logical step in the development of manned spacecraft.

Also required for a manned lunar landing mission are the various supporting operations both on the ground and in space. The cost of this supporting effort is estimated at $7 billion. Included are about $2 billion for facilities needed to test and launch the large vehicles and spacecraft being developed. This amount represents a capital investmant by this nation in its future capability to operate in space and it is thus necessary to support the development of our large launch vehicle capability.

Successful development of manned operational capability in space also requires support from other space flight operations both manned and unmanned. Approximately $1.5 billion of the estimated support funding falls in this area. Included are Project Mercury, which is already completed, as well as the lunar probes Ranger, Surveyor, and Orbiter, and the Orbiting Solar Observatory.

The remaining funds in the support area, $3.5 billion, provide for equipping and operating the world-wide manned flight net and paying the salaries of the government employees and the expenses associated with operation of the development centers that support the launch vehicle and spacecraft development.

From the outset, in addition to recognizing the urgency of a hard-driving U.S. effort in space, those most intimately concerned with re-establishing leadership have recognized that it could be achieved only through a sustained, steadily accelerating effort.

Speaking in Los Angeles on April 26, 1958, the then Director of the National Advisory Committee for Aeronautics, Dr. Hugh L. Dryden, now Deputy Administrator of NASA, said:

"I know that some knowledgeable people fear that although we might be willing to spend a couple of billions for space technology in 1958, because we still remember the humiliation caused by the appearance of the first Sputnik last October, next year we will be so preoccupied by color television, or new style cars, or the beginning of another national election campaign that we'll be unwilling to pay another year's installment on our space conquest bill. For that to happen--well, I'd just as soon we didn't start.

"Fortunately, for the sake of our children's future if not for the protection of our own skins, I don't think we're that grasshopper-minded

. . . As a nation, we have the scientific and technical competence. We have the resources to pay the bill. We can and we must succeed in finding our destiny in space."

In the opening testimony before the House Select Committee considering the Eisenhower bill for the establishment of NASA, Dr. Wernher von Braun, then head of the Army Ballistic Missile Laboratory at Redstone Arsenal, said:

". . . even more important than the budget figures for the first year is the question of how we can stabilize this program and keep it going at a sustained, accelerated rate over a number of years, how we can eliminate this lethal and wasteful hot-and-cold blowing that has plagued all our missile projects in the past. I think this lack of steady determination and unwavering support over the years has hurt us more than anything . . ."

Dr. T. Keith Glennan, the first Administrator of NASA, was even more forceful in his testimony at the first NASA budget hearings before the House Committee on Science and Astronautics. He warned:

"As I see it, success of our national space program depends on three factors: Time, money, and effort. We are behind the Russians on the time scale because they have bigger boosters. We shall have to spend large sums of money and work harder to attain our space goals as soon as we want.

"This past year, we have shown we can move, but we have only started. The need is for urgently sustained effort for years to come. If our space programs are to be run on an off-again, on-again basis, zigging and zagging with the turn of every new year, then we'd better spend our money buying telescopes to watch the Russians pioneer in space."

All of these authoritative experts agreed that continuity is a prime virtue in any large-scale research and development program. The impact of the space program on the economy--and on many other areas of our national life--could well produce unhealthy or unbalanced growth instead of stimulating a broad-based advance if the effort is not carefully planned and carried out.

Stop-and-go programs resulting from short-term reactions to current situations are by their very nature wasteful. A consistently supported level of effort over a long period of years is essential if we are to employ federal funds and industrial resources efficiently, and if we are to take full advantage of the creative abilities, skills, and enthusiasm of our scientists and engineers.

In the years ahead, we can expect continuing and necessary debate on the rate and "mix" of the space investment and on when to freeze designs and begin development of hardware for specific missions. It is extremely important that we strive to maintain a well-balanced effort, duly recognizing the potential returns from manned exploration, scientific investigations, practical applications, and possible military uses of space, with a substantial share of attention to basic research in each area.

If this debate is to serve the best interests of the country, it is essential that every citizen of influence, whether businessman, scientist, professor, government official, or military man, study and analyze all the principal reasons for a well-balanced, fast-paced space effort. The scientist who thinks only of scientific results or the businessman who looks only for economic results will not be making his most constructive contribution to the process of national decision making in this vital manner.

What is required, in the national interest, is a judicious evaluation of our national opportunities in space. We have the opportunity to lead mankind beyond the planet earth, out into the universe. If we are to insure our security and our position as leader of the Free World, and gain the scientific and economic benefits which space will surely produce, it is an opportunity we cannot afford to neglect.

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